Is Upriver Halkomelem a tone language?*

Jason Brown & James J. Thompson
University of British Columbia

Upriver Halkomelem is unique within the Salish language family as it is perhaps the only dialect of the only language to have reportedly developed a tonal or pitch-accent system. This study provides phonetic experimentation in order to determine whether the language is sensitive to pitch. Results suggest that Upriver Halkomelem may have become more sensitive to pitch than neighboring dialects, supporting the interpretation of this language as tonal.

1 Introduction

Upriver Halkomelem[1] is unique within the Salish language family as it is the only dialect of the only language[2] to have reportedly developed a tonal or pitch-accent system (all other languages in the family being stress systems). The source of this phenomenon can be attributed to the loss of glottal stop in coda position, yielding a lengthening of the preceding vowel and presumably some reinterpretation of the acoustic effect of the glottal stop on the vowel (see Elmendorf & Suttles 1960, Gerdts 1977, Kava 1972). Although it is widely attested in very good descriptive accounts of the language, tonality has been extremely hard to pinpoint. Different authors have used terms such as tone, accent, or pitched stress, but a precise account of what type of system it is, or whether there are true tonal elements to the language are lacking.

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[1] Upriver Halkomelem (Stó:lo Halq'eméylem) is a Coast Salish language spoken in the vicinity of Chilliwack, British Columbia. It is a dialect of the Halkomelem continuum, which includes the Island and Downriver dialects (see Elmendorf & Suttles 1960, Gerdts 1977).

[2] Sliammon may be a possible exception to this statement. As outlined in Watanabe (2003:410, 429-434), one form of morphological contrast is maintained "where a difference in the (secondary) stress (and pitch) marks a difference in aspect" (433).

Although there have been plenty of descriptive accounts of "tone" in Upriver Halkomelem, there has not been any intensive phonetic work done. The goal of this paper is to provide primary phonetic experimentation and data on an endangered language, and to account for a system which is potentially in a state of transition.

The outline of the paper is as follows: §2 provides a background to the relevant aspects of Upriver Halkomelem phonology, with special emphasis on the problems motivating the current study. §3 and §4 outline the phonetic experiments performed, with a discussion regarding consonant effects on pitch in other languages. Finally, §5 offers a brief conclusion.

2 Background

As mentioned above, Upriver Halkomelem is unique within the Salish family as it is the only dialect of the only language to have reportedly developed a tonal or accentual system – all other languages in the family exhibit a fairly robust stress-based system. The source of any tonal properties of the language can be attributed to the diachronic loss of glottal stop in coda position, yielding a lengthening of the preceding vowel and presumably some reinterpretation of the acoustic effect of the glottal stop on the vowel (see Elmendorf & Suttles 1960, Harris 1966, Kava 1972, Gerdts 1977, Brown 2004a). In addition to the glottal stop, the series of ejective resonants have also disappeared from the language.

An early recognition of some tonal element present in Upriver Halkomelem can be attributed to Elmendorf & Suttles (1960). Elmendorf & Suttles have noted that: "Ch [Chilliwack: the Upriver dialect; J.B., J.T.] shows further phonologic peculiarities which are apparently interpretable as a system of pitch accents, not shared with the other two dialects" (8). Elmendorf & Suttles posit a high stress (/ˊ/) vs. low stress (/ ˋ /) vs. neutral stress contrast in Upriver Halkomelem. They go on to note, however, that "preliminary analysis does not show anything very convincing as possible environmental conditions for Ch /ˊ/ and / ˋ /. Their occurrence can not be predicted from the phonemic shape of CwMs [Cowichan and Musqueam; J.B., J.T.] cognates." (9)

Following Elmendorf & Suttles, Galloway (1991, 1993) has described the Upriver dialect as something of a pitch accent language. For example, Galloway claims that: "The Upriver dialects of Halkomelem have three degrees of phonemic pitched stress or phonemic tone: /ˊ/ high pitch-stress or high tone, / ˋ / mid pitch-stress or mid tone, and (unmarked) low pitch unstressed or low tone." (1993:38). And like Elmendorf & Suttles, Galloway attempts to document the stress pattern of the language as well. Galloway goes on to describe the allophonic properties of each tonal element:

> "/ˊ/ → [ˊ⁶], loud stress with high and level pitch, which seems to be about the musical interval of a sixth above the unstressed low pitch. This allophone occurs only on short vowels immediately preceding a weakened word boundary" (1991:1)

"/ˊ/ → [̏], loud stress with high-falling pitch which starts about the musical interval of a fifth above unstressed low pitch or low tone and falls to low pitch. This allophone occurs on long vowels in word-final syllables and in free variation with [ˊ] on the last long vowel in the word in nonfinal syllables" (2)

"/ˊ/ → [ˊ], loud stress with high and level pitch varying between about a fifth and a fourth musical interval above low pitch; this allophone occurs elsewhere" (2)

"/ˋ/ has no complex allophony; it is level pitch (about a third above unstressed low pitch) with loudness ranging from moderate to loud" (2)

What is immediately striking about Galloway's descriptions is his great attention to detail, making note of the closest musical intervals and the complexity in allophonic variation.

From these reports it is clear that there is some tonal element involved in the Upriver Halkomelem phonology. What is not clear, however, is whether the system should be viewed as an accentual or tonal type of system. In contrast to this, both of the other dialects mentioned exhibit robust stress systems without any tonal contributions from their phonologies.

A brief survey of the Upriver Halkomelem lexicon shows that there exists numerous near minimal tone pairs, most ambiguous as to whether there is a tonal difference, or whether there is a stress shift. In addition, there are words that are strikingly tonal, such as /pípəhá·m/ 'frog'.[3] Although these forms don't have contrastive partners, they exhibit a high range of (consistent) pitch movement.

Aside from these items, there exists at least a single clear-cut minimal tone pair in the language which contrasts two marked tones and does not vary in vowel length:

(1) Minimal Tone Pair (Galloway 1991:3)[4]

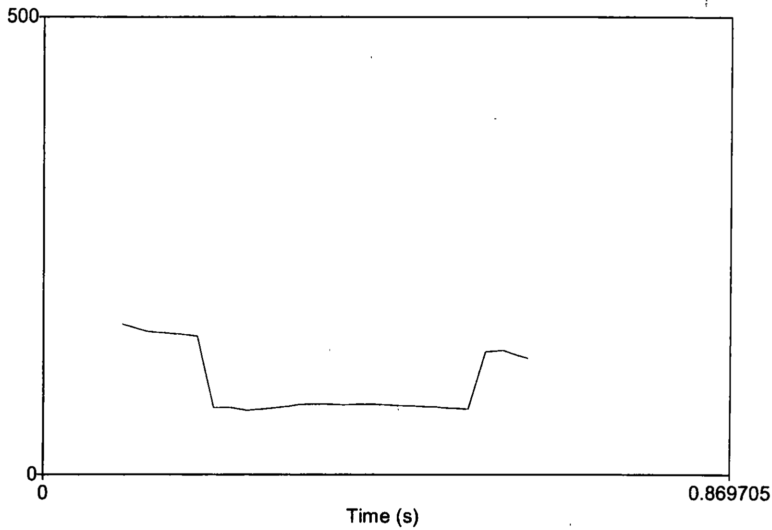
q^wá:l	'mosquito'
q^wà:l	'to speak'

Although Beckman (1986) notes that tone will carry a much greater functional load in tonal languages (i.e. contribute toward more minimal pairs), the single pair above warrants some explanation. This serves as the motivation for the current study. For example, what is the acoustic difference between examples (2) and (3) below?

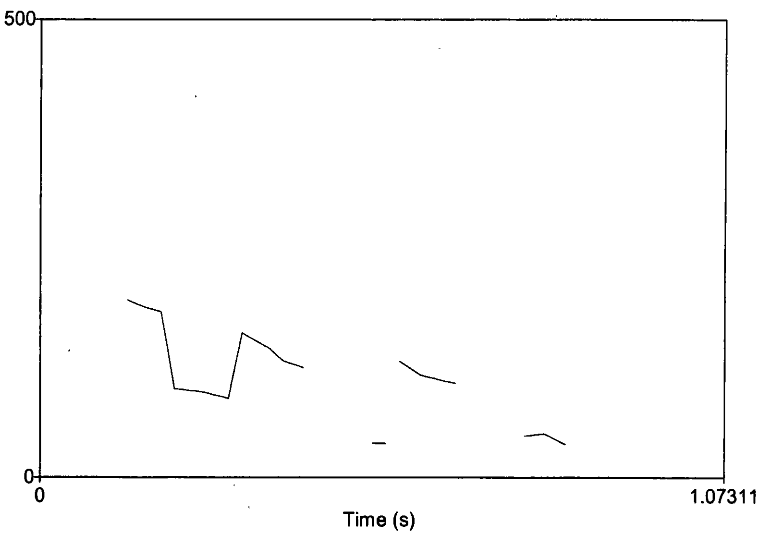
[3] This form for 'frog' is from Gerdts (1977:51).

[4] Galloway (1993:41) cites this contrast as [q^wǣ̂·l] vs [q^wæ̀·l].

(2) Pitch contour for /qʷá:l/ 'mosquito'



(3) Pitch contour for /qʷà:l/ 'to speak'



The problem with dealing with any phonological aspects of tone in the language is that it is unclear whether the language is truly tonal or not. The lack of a significant number of contrastive forms, and the possible interference from an already robust stress accent make a strictly phonological analysis nearly impossible. The following sections describe two phonetic experiments that will help to determine whether Upriver Halkomelem is a tone language or not.

3. Experiment I

It is a general observation that prevocalic stop consonants can have an effect on the fundamental frequency of a following vowel. For instance, it has been demonstrated that in English, voiceless stops raise the F0 of a following vowel relative to voiced stops (House & Fairbanks 1953, Lehiste & Peterson 1961, Lea 1973, Hombert 1976, Kingston & Diehl 1994, etc.). Furthermore, it has been argued that these effects can be responsible for tonogenesis in some languages (Maran 1973, Matisoff 1973, Hombert 1976, 1977, 1978, Hombert et al. 1979, etc.). Studies have also been conducted which show the time-course of these consonantal effects on F0. For instance, Hombert (1976, 1977, 1978) has shown that the duration of consonantal perturbations can be observed until at least 100 milliseconds past the onset of the following vowel[5] (where 'onset' is equated with the beginning of voicing) in English. In a follow-up to these findings, Hombert (1977) noted that the duration of consonantal perturbations of F0 are shorter for Yoruba (a tone language) than they are for English (a non-tone language). The explanation for such a difference is functional in nature: tone languages need to maximize the perceptual saliency of tonal elements, and tonal phonetic contrasts are compromised when F0 is perturbed through other factors.

In an experiment comparing Upriver Halkomelem to the related Island dialect (a non-tone language), we attempt to replicate Hombert's (1977) experiment in an attempt to determine whether there are any major differences in the way that each dialect handled consonantal perturbations of pitch. The purpose of this experiment is to compare the duration of pitch perturbations in each dialect in order to ascertain whether there are major differences such as are observed in comparing tonal to non-tone languages.

3.1 Methods

This experiment involves a single female speaker of Island Halkomelem and a single female speaker of Upriver Halkomelem. For the most part, the methods for data collection in this study reflect those used in Gandour (1974) and Hombert (1977). Data involving the full inventory of consonants in Halkomelem was collected, but only 4 consonants were used in the present study: the voiceless and ejective labial stops (p, p') and coronal stops (t, t'). These consonants were each paired in combination with the vowels i, a, u. This resulted in a total of 36 syllables for the Island Halkomelem subject (4 consonants x 3 vowels x 3 tokens = 36). Because of some experimental difficulties encountered (in particular some hearing loss), a much more limited set of tokens was collected for Upriver Halkomelem (12 total syllables).

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[5] Hombert used the tense vowel /i/ in his experiment on English subjects, which has a longer duration than lax counterparts.

Stimulus items were placed in the carrier phrase 'tsil x̱ete ___ qelat' and 'chen x̱ete __ qelʔat' (for Upriver and Island, respectively), meaning 'I said ___ again'. There are no obvious tonal effects associated with the carrier phrase. The carrier phrase was used for consistency across both dialects, and to ensure that the stimulus items were embedded in Island and Upriver Halkomelem contexts. The Island Halkomelem subject was instructed to read the stimulus list at a normal rate. The Upriver Halkomelem subject was presented with stimuli orally before being asked to produce items.

Data was recorded in the field using a Marantz PMD670 solid state recorder. Digital files were then transferred directly to computer where they were analyzed using Praat (version 4.1.14). Measurement and analysis followed the methods of Hombert (1977). Fundamental frequency measurements were taken at six different locations: at the onset of voicing for the vowel, then at 20, 40, 60, 80, and 100 milliseconds past vowel onset.[6]

3.2. Results

In order to ensure that individual vowel qualities were not having a masked effect on the overall pitch contours, F0 was analyzed by separating vowel qualities out. Figure 1shows F0 over time for the Island ejective labial stop, and Figure 2 shows the plain labial stop. The trajectories of F0 for the three vowels were as expected.

[6] VOT for the Halkomelem stops has not been formally investigated, but is presumably important in considerations of methodology. Thanks to Joe Stemberger for pointing this out. These issues will be left for future research.

Figure 1: The Island Halkomelem ejective series split by vowel

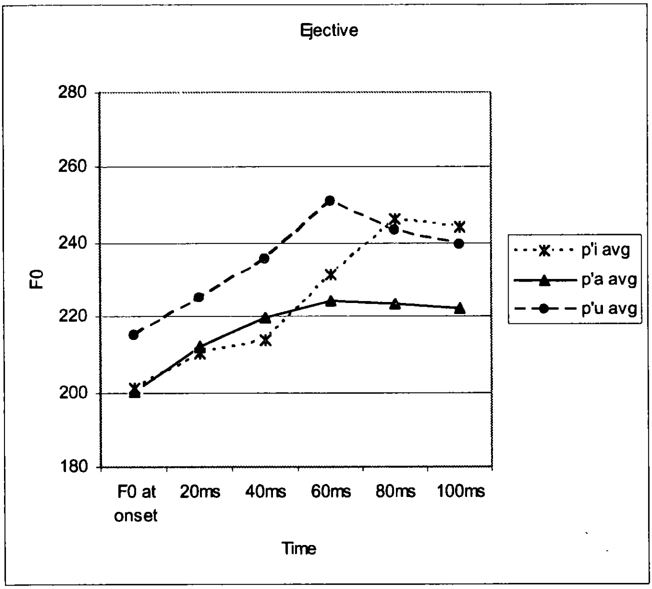
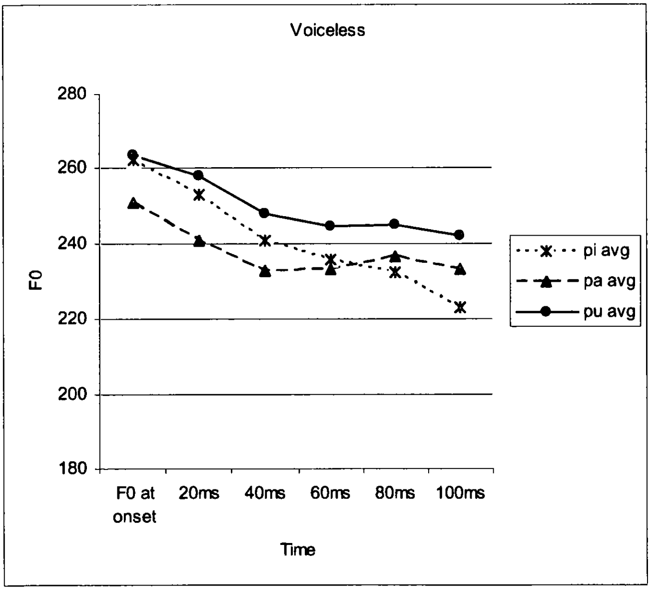


Figure 2: The Island Halkomelem voiceless series split by vowel



Next, the vowels were averaged together. As can be seen below in Figures 3 and 4, the contrast between the two series of stops with regard to perturbation of F0 resembles the contrast between voiceless and voiced stops in other languages: voiceless stops were consistently associated with an initially higher F0 for the following vowel than were their ejective counterparts. This is also in line with the scale of consonant types proposed by Hyman & Schuh (1974).

Figure 3: Island Halkomelem labial stop influences on F0

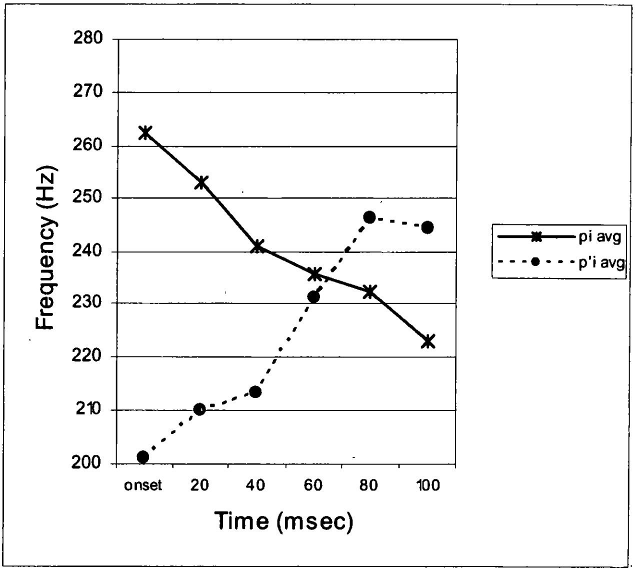


Figure 4: Island Halkomelem coronal stop influences on F0

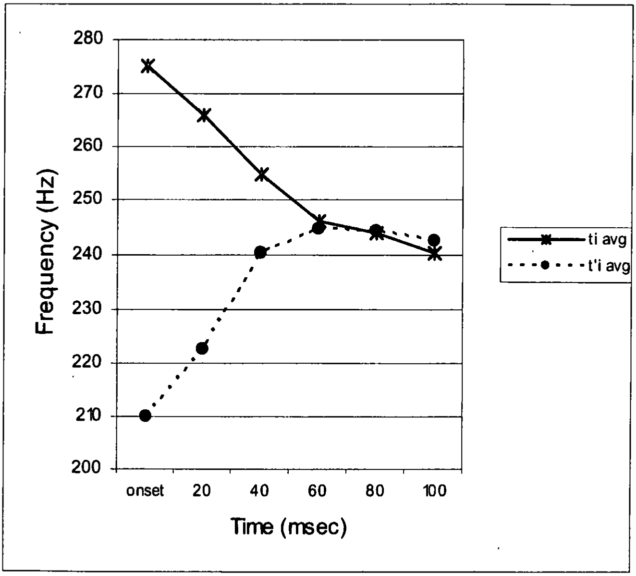


Figure 5: Upriver Halkomelem labial stop influences on F0

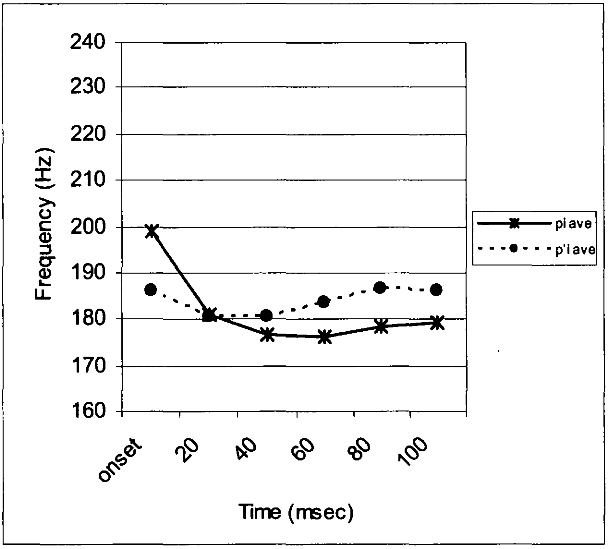
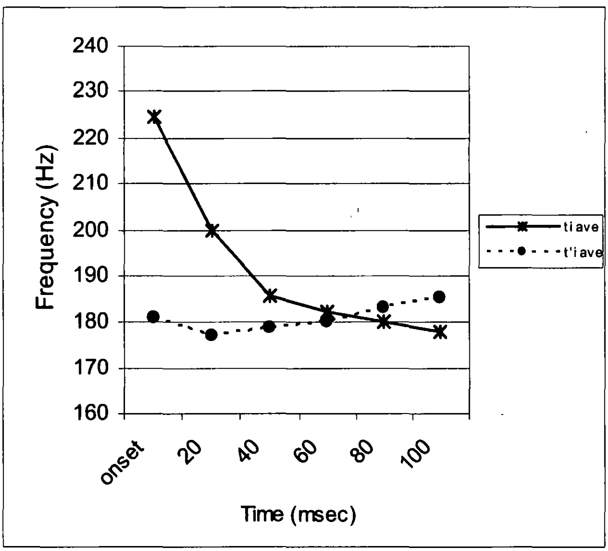
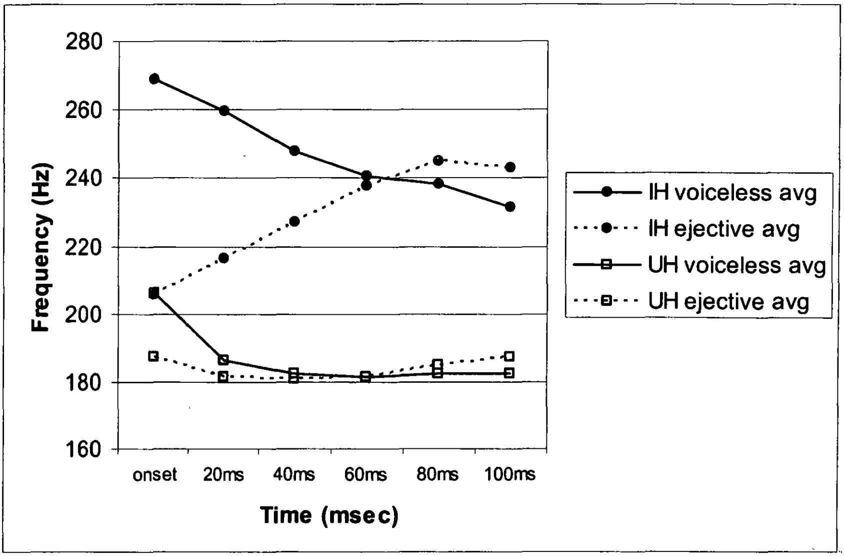


Figure 6: Upriver Halkomelem coronal stop influences on F0



Although the number of tokens was not enough to determine the statistical significance of the duration of perturbations, a qualitative assessment of the data indicates that the Upriver perturbations seem to level out 20-40 msecs. earlier than the Island data. This is illustrated in Figure 7 below, where results for both Upriver and Island Halkomelem are layered on top of each other:

Figure 7: Comparison of Upriver vs. Island Halkomelem perturbations by consonant type



3.3. Discussion

The F0 curves in the graph above can be placed in a more general cross-linguistic context. Although onset values for F0 are not regularly reported in the literature, at least 5 different languages can be contrasted here (Hombert's Yoruba data is not included due to F0 being split by tones and also being difficult to average visually). In terms of F0 at onset, Thai shows the smallest magnitude of difference between the stop series. Upriver Halkomelem patterns closely with the English or Swedish data. Island Halkomelem, on the other hand, shows more than twice the magnitude of difference between onset F0 for voiced (or ejective) and voiceless contexts than the next highest language in the table, Swedish. (These comparisons, however, must be taken with a grain of salt, as the F0 differences presented here are from different languages with different consonant types, and also presumably different vowels).

Table 1: F0 differences across select languages

Language	Voiced (or Ejective)	Voiceless	Difference
English (Hombert 1976)[7]	119	135	16
English (Mohr 1971)[8]	116.3	133.5	17.2
Swedish[9]	121.83	148.25	26.42
Thai (Brown 2004b)	215.92	223.1	7.18
Upriver Halkomelem	187.3	206.33	19.03
Island Halkomelem	195.99	250.78	54.79

It is interesting to note that the ejective stops don't perturb pitch in Upriver Halkomelem (where the pitch contours remain relatively flat), but in Island Halkomelem they perturb pitch just as much as voiceless stops. This unique difference fits nicely into Ohala's (1993, 2003) model of sound change. Ohala's model is a phonetically-based system of sound changes which takes into account both the speaker and the listener. Under this model, there is a reanalysis of the intrinsic effect as an independent effect (the process of phonologization). Following this is a step where the effect is magnified, then the effect is spread to the following vowel. Finally, there is a loss of the original contrast, and something like a full-blown tonal contrast would exist. The model predicts that there should be a range of languages found in each step of this process, but thus far the literature reports languages at the initial stage or at the final stage. The Halkomelem scenario is perhaps an intermediate case. It is possible that listeners of Island Halkomelem inadvertently magnified the difference in F0 between the voiceless and ejective stops to an above average level through hypercorrection: a greater phonetic contrast is developed through the failure to disambiguate two acoustically similar sounds. This would result in the exaggerated difference each series has on pitch. On the other hand, Upriver Halkomelem has reduced this difference in F0 in order to maximize the perceptual saliency of pitch. Hombert (1978:91) suggested that "available data seem to indicate that ejectives are neutral with respect to tonal development." Though this may be true for all known cases of tonogenesis, the Halkomelem data presented here indicates that it is not due to a neutralization in contrast of pitch perturbation. Rather, it seems that the effect that ejective stops have on pitch in Island Halkomelem has disappeared, leaving only voiceless stops with a noticeable effect on pitch.

Hombert's (1977) observation is that perturbations of pitch due to the laryngeal state of consonants are eliminated more quickly in tone languages than in non-tone languages in order to avoid interference with the perception of (contrastive) tones. Preliminary data suggests that this difference is present in contrasting Island Halkomelem (a non-tone language) vs. Upriver Halkomelem

[7] Figures were estimated from Figure 1 (Hombert 1976:25).

[8] Mohr includes {bdgv} in the voiced series, and {ptkf} in the voiceless. The values given above are from CVC contexts. The values for CVC and VC*V* contexts averaged together are 123.05 (voiced) and 134.6 (voiceless) with a resulting 11.55 difference.

[9] Data from Lövqvist (1975:241). Löfqvist's data for tonal accents 1 and 2 were here averaged together, as well as the data for long and short vowels.

(putatively a tone or pitch-accent language). The data also suggests that Island Halkomelem may have already phonologized the F0 perturbations caused by plain vs. ejective stops. The shortening of the effects of the consonantal perturbations must come later, after the tonal contrast arises.

Finally, while much of the literature on consonantal effects on pitch is dedicated to voiced vs. voiceless contrasts, the results presented here are for a plain vs. ejective contrast. Regarding ejectives, Hombert (1978:91) has noted that "phonetic data is badly needed with respect to this class of consonants." The data presented above suggests that in a system that contrasts a plain (voiceless) stop with an ejective stop, the ejective will pattern as would a voiced stop: by lowering the pitch of a following vowel. Again, this is what is predicted by the hierarchy of consonant types proposed by Hyman & Shuh (1978), and this type of behavior is also consistent with the "lax" type of ejective discussed in Kingston (1984).

4 Experiment II

While the results obtained from the first experiment are suggestive, they alone may not justify an interpretation of the language as tonal. In order to add a more naturalistic aspect to the study, another experiment was designed to use actual Upriver Halkomelem lexical items.

4.1 Methods

The design of this experiment is based on Experiment I, except that real lexical items in Upriver Halkomelem were used. Again, each consonant series was tested (p, p', t, t'), with the target consonant in word-initial position. The following vowel in each item was the high front vowel /i/. Two lexical items were selected for each consonant, and there were 3 tokens collected for each lexical item. This resulted in 24 total words (4 consonants x 2 lexical items x 3 tokens). The carrier phrase was again "tsil x̲ete _____ qelat'." Following the methods outlined for Experiment I, fundamental frequency was measured at 20 msec. intervals from vowel onset to 100 msecs. Results from this experiment were not compared to an Island Halkomelem set of results for the same stimulus items; rather, they were compared to the original results from Experiment I.

4.2 Results

Both series of stops exhibited patterns of pitch perturbation that are completely expected at this point. Voiceless stops raise pitch at the point of vowel onset, while ejective stops will either lower pitch or have little effect at all. These effects can be seen in Figure 8 for the labial stops, and in Figure 9 for the coronal stops.

Figure 8: Upriver Halkomelem labial stop influences on F0

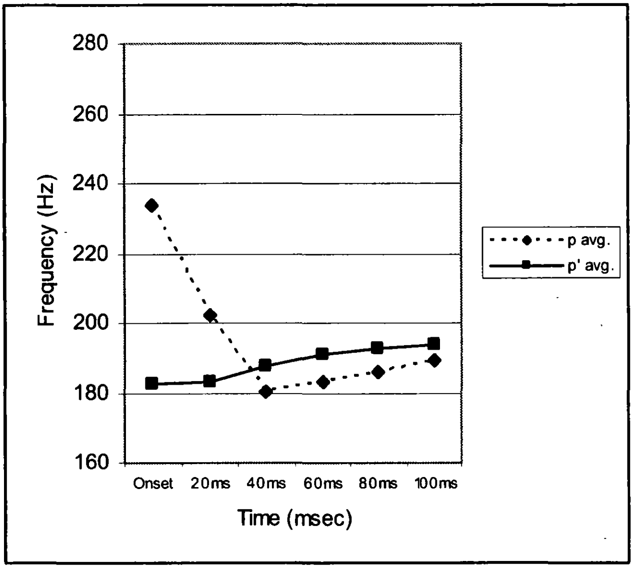
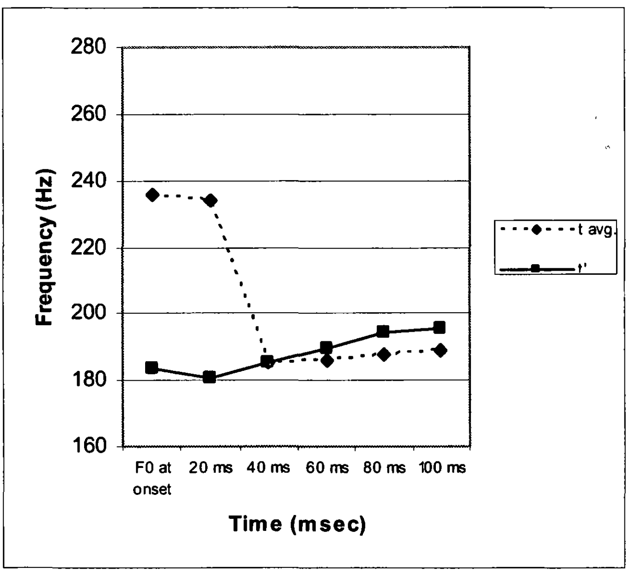


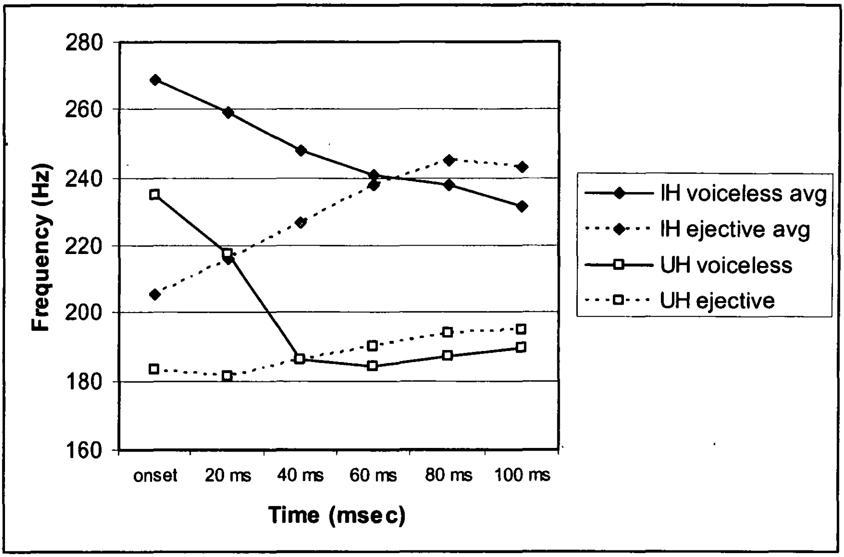
Figure 9: Upriver Halkomelem coronal stop influences on F0



4.3 Discussion

The results for experiment II are similar to the results from experiment I. In each case the plain stops raised pitch, while the ejective stops either lowered pitch or had little visible effect. While the magnitude of pitch difference between the two series of stops was greater at vowel onset for Experiment II than Experiment I, the pitch values for both series met at around 40 msecs. or earlier, which closely resembles the patterns identified in experiment I. Although there is at the moment no comparison to be made with Island Halkomelem in terms of real lexical items, a comparison of the results from Experiment II are compared with the Island results from Experiment I below (Figure 10).

Figure 10: Upriver Halkomelem (real) vs. Island Halkomelem (nonsense) items



Again, this does not provide us with a direct comparison between Upriver and Island Halkomelem lexical items, but it does give us a fairly good estimation of the degree of variance between nonsense and real stimuli.

5 Conclusion

In this paper, we have provided a background discussion of tone in Upriver Halkomelem and provided acoustic data in order to test for tonality in the language. The results from two experiments performed on two dialects of Halkomelem (one a stress language, one reportedly a tonal language) indicate that there is a significant difference in the duration of consonantal perturbations when comparing the two languages. The results of the experiments performed in this paper have been placed in the context of Hombert's observation that the consonantal perturbation of the fundamental frequency of following vowels will be shorter in tone languages than in non-tone languages. While the Island Halkomelem results indicate a greater duration for perturbation, the Upriver Halkomelem results suggest a much smaller duration. This suggests that Upriver

Halkomelem may have become more sensitive to pitch than neighboring dialects, supporting the interpretation of this language as tonal. Finally, this paper provided phonetic data on the perturbation patterns of ejectives, a consonant type that has been largely underrepresented in the literature to date.

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Jason Brown
jcb@interchange.ubc.ca

James J. Thompson
jramp@interchange.ubc.ca